

## CLAIMS

1 *22* 1. An input/output platform (IOP) access module for providing input/output device  
2 access between a host system and another system comprising:

3 a Local Transport arranged to provide an interface to an input/output platform (IOP)  
4 supporting an array of input/output devices;

5 a Remote Transport arranged to provide an interface to said another system; and

6 a Connection Manager arranged to establish connection services and to create a direct  
7 call path between the Local Transport and the Remote Transport so as to provide access to  
8 input/output devices.

9 2. The input/output platform (IOP) access module of claim 1, wherein said IOP  
10 access module is one of a hardware module, a combined hardware/software module, and a  
11 software module provided on a tangible medium.

12 *22* 3. The input/output platform (IOP) access module of claim 1, wherein said host  
13 system corresponds to a host server, said another system corresponds to any one of remote  
14 servers, with said host server and said remote servers being arranged on a computer network.

1 4. The input/output platform (IOP) access module of claim 2, further comprising said  
2 IOP which comprises:

3 at least one or more input/output processors;

4 at least one storage device as said input/output devices;  
5 a device driver module arranged to interface with said storage device;  
6 a communication layer which defines a mechanism for communications between the  
7 Local Transport and the device driver module.

1 5. The input/output platform (IOP) access module of claim 4, wherein said  
2 communication layer is responsible for managing all service requests and providing a set of  
3 Application Programming Interfaces (APIs) for delivering messages, along with a set of  
4 support routines that process the messages.

5 6. The input/output platform (IOP) access module of claim 5, wherein said  
6 communication layer comprises a message layer which sets up a communication session, and  
7 a transport layer which defines how information will be shared.

8 7. A host system, comprising:

9 a processor;

10 an array of storage devices;

11 a driver module for exporting local storage device access onto a computer network,

12 said driver module comprising:

13 a device driver module arranged to provide an interface to said array of local  
14 storage devices;

1 a host driver module arranged to provide an interface to an operating system,  
2 said system driver module comprising a Local Transport which communicates with the  
3 device driver module, a Remote Transport which provides an interface to said  
4 computer network, and a Connection Manager which establishes connection services  
5 with remote systems on said computer network and which creates a direct call path  
6 between the Local Transport and the Remote Transport to provide access to said  
7 storage devices; and

8 a communication layer which supports communications between the host driver  
9 module and the device driver module.

10 8. The host system of claim 7, wherein said host system corresponds to a host server,  
11 said remote systems corresponds to remote servers arranged in a cluster, and said computer  
12 network corresponds to a system area network for communications between said host system  
13 and said remote systems within said cluster.

14 9. The host system of claim 7, wherein said communication layer is responsible for  
15 managing all service requests and providing a set of Application Programming Interfaces  
16 (APIs) for delivering messages, along with a set of support routines that process the  
17 messages.

1           10. The host system of claim 9, wherein said communication layer comprises a  
2 message layer which sets up a communication session, and a transport layer which defines  
3 how information will be shared.

1           11. The host system of claim 9, wherein said system driver module and said device  
2 driver module constitute a single device that is portable across a plurality of operating  
3 systems and host network platforms, and works interoperably with a plurality of storage  
4 devices and operating systems.

15UB B3 12. The host system of claim 9, wherein said system driver module and said device  
2 driver module operate in accordance with an Intelligent Input/Output (I<sub>2</sub>O) specification for  
3 allowing storage devices to operate independently from the operating system.

1           13. The host system of claim 7, wherein said driver module is one of a hardware  
2 module, a combined hardware/software module, and a software module provided on a  
3 tangible medium.

1           14. A driver configuration of a host server for exporting local storage device access  
2 onto a computer network, comprising:  
3 an input/output platform (IOP) arranged to control an array of local storage devices;  
4 and  
5 a system driver module comprising:

6 a Local Transport arranged to provide an interface to said input/output  
7 platform (IOP);

8 a Remote Transport arranged to provide an interface to said computer  
9 network; and

10 a Connection Manager arranged to establish connection services with  
11 remote servers on said computer network and coordinate functions responsible  
12 for creating a direct call path between the Local Transport and the Remote  
13 Transport to provide access to the local storage devices.

14 15. The driver configuration of claim 14, wherein said input/output platform (IOP)  
15 supports at least one or more input/output processors, and comprises:

16 a device driver module which interfaces the local storage devices for controlling said  
17 array of local storage devices; and

18 a communication layer which defines a mechanism for communications between the  
19 system driver module and the device driver module.

20 16. The driver configuration of claim 15, wherein said communication layer is  
21 responsible for managing and dispatching all service requests and providing a set of  
22 Application Programming Interfaces (APIs) for delivering messages, along with a set of  
23 support routines that process the messages, and is comprised of a message layer which sets up  
24 a communication session, and a transport layer which defines how information will be shared.

1           17. The driver configuration of claim 15, wherein said system driver module and said  
2 device driver module constitute a single device that is portable across a plurality of host  
3 operating systems and host network platforms, and works interoperably with a plurality of  
4 storage devices and host operating systems.

1           18. The driver configuration of claim 15, wherein said system driver module and said  
2 device driver module operate in accordance with an Intelligent Input/Output (I<sub>2</sub>O)  
3 specification for allowing storage devices to operate independently from the operating system  
4 of the host server.

1           19. The driver configuration of claim 15, wherein, upon initialization, said Local  
2 Transport scans the local bus so as to locate and initialize all local input/output platforms  
3 (IOPs) and builds an opaque "context" structure for each input/output platform (IOP),  
4 wherein said Remote Transport prepares to accept requests from a remote server through said  
5 computer network, and wherein said Connection Manager queries said Local Transport so as  
6 to determine the number of input/output platforms (IOPs), builds an IOP descriptor structure  
7 for each input/output platform (IOP) which includes an exported table of function call  
8 pointers and the context required by the Local Transport to communicate with the  
9 input/output platform (IOP), and finally establishes a network management communication  
10 channel through the Remote Transport, which waits for an external connection from said  
11 remote server on said computer network for exporting local device access onto said computer  
12 network using said direct call path between the Local Transport and the Remote Transport.

1           20. The driver configuration of claim 19, wherein said Local Transport further has a  
2 send handler function and said Remote Transport further has a receive handler function which  
3 are respective program interfaces for receiving an inbound message from a remote server on  
4 said computer network for direct access to local input/output platform and for delivering an  
5 outbound message to said remote server on said computer network.

1           21. The driver configuration of claim 19, wherein said Remote Transport further  
2 builds an IOP connection structure including at least an IOP descriptor pointer which refers to  
3 the IOP descriptor structure of the Connection Manager for making a direct call to the Local  
4 Transport through the receive handler function and the send handler function.

1 SUB B4) 22. A process of exporting storage device access onto a computer network using an  
2 input/output platform (IOP) access module of a host server, comprising the steps of:  
3           providing an interface to an input/output platform (IOP) supporting an array of storage  
4 devices;  
5           providing an interface to a remote server on said computer network;  
6           establishing service connection between said host server and said remote server on  
7 said computer network in response to a request from a remote server on said computer  
8 network; and  
9           providing a direct call access to said storage devices for said remote server to share  
10 resources of said storage devices while bypassing operating system protocol stacks.

23. A process of establishing a service connection to a local input/output platform (IOP) connected to a local bus using a driver module in response to a request from a remote server on a system area network, comprising the steps of:

beginning initialization of said driver module which provides access to a local storage system while bypassing protocol stacks of a host operating system, said driver module comprising a Local Transport which provides direct access to the local storage device system, a Remote Transport which interfaces to other nodes of said system area network, and a Connection Manager which provides connection services and coordinating functions responsible for creating a direct call path between the Local Transport and the Remote Transport;

scanning, at said Local Transport, the local bus to locate and initialize all local input/output platforms (IOPs), and building an IOP context structure for each input/output platform (IOP) found;

preparing, at said Remote Transport, to accept a request for a service connection from said remote server on said system area network;

asking, at said Connection Manager, whether said Local Transport determines the number of input/output platforms (IOPs), and building a descriptor structure for each input/output platform (IOP) which includes an exported table of function call pointers and the context required by the Local Transport to communicate with the input/output platform (IOP); and

establishing a system area network management communication channel through the Remote Transport, which waits for an external connection from said remote server on said



23 system area network for exporting local device access onto said system area network using  
24 said direct call path between the Local Transport and the Remote Transport.

1 24. The process of claim 23, wherein said input/output platform (IOP) comprises:  
2 a device driver module which interfaces the local storage devices, and which controls  
3 an array of local storage devices; and  
4 a communication layer which defines a mechanism for communication between the  
5 system driver module and the device driver module.

1 25. The process of claim 24, wherein said communication layer is responsible for  
2 managing and dispatching all service requests and providing a set of Application  
3 Programming Interfaces (APIs) for delivering messages, along with a set of support routines  
4 that process the messages, and is comprised of a message layer which sets up a  
5 communication session, and a transport layer which defines how information will be shared.

1 26. The process of claim 23, wherein said system driver module and said device  
2 driver module constitute a single device that is portable across a plurality of host operating  
3 systems and host network platforms, and operate in accordance with an Intelligent  
4 Input/Output (I<sub>2</sub>O) specification for allowing storage devices to operate independently from  
5 the host operating system.

1           27. The process of claim 23, wherein said Local Transport further has a send handler  
2 function and said Remote Transport further has a receive handler function which are  
3 respective program interfaces for receiving an inbound message from a remote server on said  
4 system area network for direct access to local input/output platform (IOP) and for delivering  
5 an outbound message to said remote server on said system area network.

1           28. The process of claim 27, wherein said Remote Transport further builds an IOP  
2 connection structure including at least an IOP descriptor pointer which refers to the IOP  
3 descriptor structure of the Connection Manager for making a direct call to the Local  
4 Transport through the receive handler function and the send handler function.